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Nesting Notes on the European Hornet in North Carolina

By DAVID L. WRAY, Raleigh, N. C.

The European Hornet (*Vespa crabro* var. *germana* Christ) was first recorded in North Carolina when a single male was taken near the railroad tracks on the State College campus in Raleigh, October 5, 1940 ("Supplement to Insects of North Carolina," 1942, C. S. Brimley). Our next record of this species was Sept. 22, 1944, when J. A. Harris collected 1 male and 3 females at Guilford College (Guilford Co.) and saw 6 others feeding heavily on *Ligustrum* shrubs and apparently doing some damage to a nursery there. M. W. Wing (ENT NEWS, vol. LX, January 1949) gives four other records of this species within the State: Greensboro, Reidsville, Carthage, and Mocksville. The Greensboro record is of 1 female and a portion of a nest, in early October 1946. The following records and notes from our Insect Survey will show its present distribution and would indicate that it is firmly established from a nesting standpoint.

The general distribution of this species as of this date (December 1952) in North Carolina would lie in the central or Piedmont area of the State, bounded on the east by a line drawn in a southwesterly direction through Raleigh (Wake Co.) and Aberdeen (Moore Co.), and on the west in a southwesterly direction along the lower edges of the Mountain region proper from Wilkes County on the North through Rutherford County on the southwest. So far we have no records for the large eastern or Coastal Plain section, nor for the Mountain region

proper. Many of the records and specimens for this central region resulted from my article on this species in the *Agricultural Review* (1950).

Probably the first record of this species nesting in North Carolina was made by O. E. Brown, an apiarist and a keen observer of nature, near Asheboro in the summer of 1945. This is in the center of the State and some 25 miles south of Greensboro.

Nesting and Distribution Records

This species has been found nesting from Raleigh on the east to as far west as Rutherford County, with many places in between. It has been recorded as occurring in nineteen counties in this central section.

The following locality records and notes about its habits will give its status in North Carolina.

Raleigh (Wake Co.): A nest was found in the barn of F. G. James hanging from the apex of the roof and inside a loft. It was about 2 feet long and about 10 inches in diameter. I collected this nest in October 1950 when it was empty. In August 1950 J. B. Lyon brought in some large lilac limbs from his place 12 miles north of town which had been girdled by the hornets gnawing small pieces of the bark off (about 1 inch wide and 2 inches long). On August 15, 1950 I observed a large nest built in a large oak tree with a hollow about 3 feet up from the ground, located 5 miles north of town. The hornets were working in and out like a large swarm of bees, some feeding on the sap exuding from a bruised place on the tree nearby. Cary (Wake Co.): Adults observed feeding on sap from an oak tree. Neuse (Wake Co.): Two nests were found here in trees, and one in a house by J. J. Taylor. Leesville (Wake Co.): Nesting in tree in yard of O. J. Smith. Durham (Durham Co.): Reported stinging a farmer near here and causing hospitalization. Chapel Hill (Orange Co.): On August 19, 1950 I observed a nest on the farm of T. W. Brown. It was built in a large hollow of a white oak tree about 3 feet up from the ground, and on the banks of a creek. He states that they nested here in

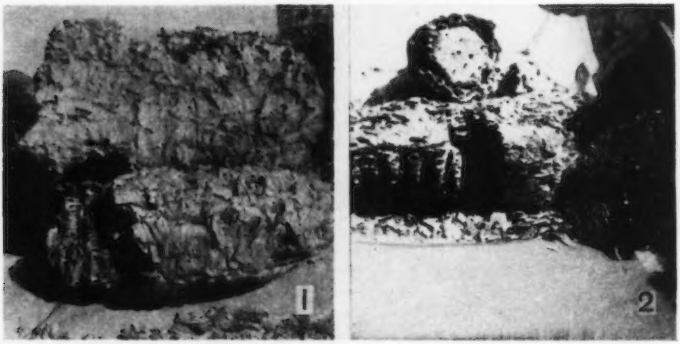

FIG. 1. Top nest: from tobacco barn, Mocksville, N. C. (3 feet long). Bottom nest: from Raleigh, N. C. FIG. 2. Nests torn open to show combs.

1949. Oxford (Granville Co.): Two adult specimens were collected by Mr. Stahl of the Experiment Station. Burlington (Alamance Co.): 3 specimens were sent in by Geo. E. Curtis, who states that they are nesting here. Aberdeen (Moore Co.): One specimen from here and they were reported as catching and eating honey bees. Asheboro (Randolph Co.): O. E. Brown found them first nesting here in 1945 and 1946, and each year since. On August 9, 1950 a nest was found between the roof and ceiling of a grain storage building, and I observed a portion of this nest. Near here, another farmer reported a nest in a tree and complained that the hornets were feeding on his apples. I went with Mr. Brown to his orchard and observed the hornets come to the ripening apples. They would sit on an apple and begin to gnaw a small hole through the skin by moving around in a circle, then enlarge the hole to about a half to three-fourths inches in diameter, all the time gnawing out the inside. After that they would concentrate on eating the "meat" out. Several apples were found, under the trees, that consisted only of the outside skin or peeling and the central core part. Star (Montgomery Co.): In August 1950 Mr. Brown took me to a large nest in the northern part of this county. It was built in a

hollow maple tree, near a barn, with an opening about 10 feet from the ground. On a nearby large oak tree we observed hornets feeding on exuding sap. Around this place were found many bits of insect bodies, mostly wasps, beetles, etc., upon which the hornets had fed. We watched them catch other wasps. Indian Trail (Union Co.): On August 23, 1950, T. E. Cartner submitted specimens and stated that large numbers were attacking trees and damaging bark. Mathews (Mecklenburg Co.): In the summer of 1950, a nest was found in an old hollow tree near a house by V. L. Stilwell. The hornets were working "in and out of the tree like bees." Salisbury (Rowan Co.): Specimens were taken here September 28, 1951 by W. J. Walton. Mocksville (Davie Co.): A large nest was taken here on August 25, 1950 by A. E. Hendrix. This nest was the largest found within the State so far. It was built inside a tobacco barn up in a corner near the roof. It was 36 inches long and 20 inches in diameter, and fastened at the top and two sides. Cana (Davie Co.): Adults taken here were girdling lilac bushes. Mrs. C. F. Sofley stated that "they cut a strip of bark off about one inch wide all around the stems." Winston-Salem (Forsyth Co.): A colony, in the basement of a house, that had built a nest about the size of a gallon bucket was destroyed by spraying. They were attacking lilac bushes also. Sherman Shore reported them feeding on sap from a large oak tree, and also observed them around lights at night where they appeared to feed on insects attracted by the lights. Kernersville (Forsyth Co.): Feeding on apples. W. G. Entrekin states that "they eat all the apple leaving only the skin and core. People pick up apples with a dinner fork to avoid stings." Leaksville (Rockingham Co.): A nest that was found here in a barn by L. J. Griffin was 18 inches long and 12 inches in diameter. Madison (Rockingham Co.): Hornets were observed feeding on honey bees, and also on watermelon rinds and on sap exuding from a willow tree. East Bend (Yadkin Co.): One specimen. Elkin (Surry Co.): A nest was found here by Lin Hendren built inside the weatherboarding of a frame house. Many specimens

and a portion of the nest were sent to me for examination. Benham (Wilkes Co.): A large nest was found here by Raymond Harris, built inside of an old log house. The nest was hanging down from the rafters and was almost as large as a half bushel basket. Maiden (Catawba Co.): Specimens were taken here September 15, 1951. Union Mills (Rutherford Co.): Specimens were taken here and there was a nest in a large tree. This is the farthest locality to the southwest and is in the upper foothills at the base of the mountain region proper.

The Nest

The nest of the European Hornet is generally large in size and is composed of many layers of combs, about 24 in the largest nest found at Mocksville. These combs are constructed with intercomb supports of matrix. Those nests examined that were hanging in barns are completely covered with a tan to light brownish paper material, somewhat laminated in appearance. All along the sides were entrance tubes which opened several inches from the horizontal entrance and extended upward to the floor entrance; thus by turning the nest upward one could see many openings protected by these tubular structures. The paper of the nest is very brittle and the nests are damaged by handling, no matter how carefully done. Upon rubbing some of the material in one's hand it appears like a coarse sawdust that has been worked together into paper and that crumbles easily.

Notice to Homopterists

Professor Z. P. Metcalf, of the University of North Carolina, has received a grant-in-aid from the National Science Foundation for continuing the publication of the Catalogue of the Homoptera. He is now asking the cooperation of all homopterists for help in securing reprints and other data relating to the Auchenorhyncha (Fulgorids, Jassids, Cicadas, and Membracids). For detailed information please write to Professor Metcalf, Box 5215, State College Station, Raleigh, N. C.

Biological Notes on Psammaecius tricolor (Cresson) (Hymenoptera: Sphecidae: Gorytini)

By H. E. Evans, C. S. Lin, and C. M. Yoshimoto,
Cornell University, Ithaca, N. Y.

On August 18, 1952, numerous specimens of *Psammaecius tricolor* (Cresson) were found nesting by the writers at Ulysses, Grant Co., in southwestern Kansas. Our observations cover but a single day and are by no means complete, but considering the scarcity of information on the biology of wasps of this group, they seemed worth reporting at this time. We are indebted to Karl V. Krombein for identifying *P. tricolor* and its parasite *Nysson bellus* Cresson for us, and to David A. Young for identifying the leafhopper prey of *tricolor*. These studies were made as part of a project on the comparative behavior of solitary wasps, supported by the National Science Foundation on grant number G-248.

The Gorytini are predominantly soil-nesters which utilize Homoptera Auchenorhyncha as prey. The species of *Psammaecius* which have been previously studied prey upon Membracidae. *P. costalis* (Cresson) preys upon several genera of adult Membracidae (Reinhard, 1925a) while *P. nebulosus* (Packard) uses nymphs of several genera (Pate, 1946; Krombein, 1953; unpublished observations of writers); there is one record of *P. spilopterus* (Handlirsch) taken with an adult membracid (Pate, 1946). The nesting behavior of *costalis* is best known, having been described in some detail by Reinhard (1925a and later in "The Witchery of Wasps," 1929). Krombein (1953) has recently published observations on the nesting of *nebulosus*. *Psammaecius tricolor* differs from all these species in that it preys upon Cicadellidae; several features of its nesting behavior have not been noted for the other species.

Ecology. This aggregation of *P. tricolor* consisted of 40–50 nesting females, of which 12 were observed in some detail. No males were encountered. The site was a small flat sandy area

at the lower edge of a sloping fallow field, apparently formed by erosion from the field. The top three or four inches were light sand, below this a sandy loam. Numerous low spreading plants were scattered over the sand, the most abundant a species of *Euphorbia*. Below the edge of the field the land sloped away and was covered with a dense growth of various herbs, finally dropping off to a grassy area along a small stream which flowed into the North Fork of the Cimarron River about half a mile away. A species of *Sphex* and a *Plenoculus* were also nesting here.

The first specimens were seen at 11 A.M., and observations were made from then until 7 P.M., when most activity had ceased. All the nests were located near the bases of plants, and none of them in the more open stretches of sand. None of the nests were less than 4 inches apart and most of them were separated by a foot or more. All of our observations were made at the nesting sites, as we were unable to trace the wasps to the source of their prey, and hence did not observe the capture of the prey.

Provisioning the nest. *Psammaecius tricolor* was using only one species of leafhopper as prey in this locality: *Parabolocratus brunneus* Ball. The nineteen cells which were eventually examined contained 194 of these green leafhoppers, of which 191 were adult females and the other three last instar nymphs. The prey is carried to the nesting site in flight, held tightly beneath the body. The flight of this species is rather slow, and the wasp characteristically lands several inches away from the nest entrance (sometimes on a plant) rather than flying directly to it. On landing, the wasp stands on its front and hind legs and holds the leafhopper with the middle legs, venter-up, tightly against the under side of its thorax and abdomen. After landing and before entering the burrow the wasp invariably moves its abdomen up and down rather slowly in a broad arc, while holding the wings motionless at a slight angle from the horizontal. These movements of the abdomen are highly characteristic, and we have not observed similar movements in other gorytine wasps which we have studied.

After landing the wasp pauses a moment, then walks or takes one or more short flights to the burrow. In cases where we had in any way disturbed the immediate vicinity of the burrow, the wasp had difficulty in locating it, and would occasionally dig in two or three different spots before finding it. On arrival at the burrow, the entrance is opened with a few strokes of the front legs while still holding the leafhopper with the middle legs and standing on the hind legs. The wasp then enters the burrow directly, leaving it open while inside. Usually less than half a minute is spent inside the burrow; on leaving, the nest is closed with some care from the outside, and the wasp flies off. The amount of time required to obtain another leafhopper varies considerably; the minimum time recorded was 3 minutes, the average somewhere between 5 and 10. One very active specimen was observed to bring in 10 leafhoppers in 50 minutes; another brought in 8 in 30 minutes. Without exception the burrow is closed when the wasp leaves to fly after prey, and left open while it is inside. However, on a number of occasions it was noted that the wasp stayed in the burrow an unusual length of time (about 15 minutes) and at these times threw up a certain amount of earth from the inside. We concluded that these intervals were used to dig a new cell.

Eleven nests were eventually dug out. The length of the burrow to the deepest cell averaged 10.5 cm. (ranging from 7 to 14 cm.); the depth of the deepest cell beneath the surface was 6 (4–8) cm.; the angle formed with the horizontal averaged 35°. The diameter of the burrow was about 3 mm., that of the cell about 7 mm. Most of the burrows were straight or nearly so. Four of these nests had been completed and had received the final closure; of these one had two cells, two had three cells, and one had four. In the nest with four cells, the two deepest cells contained larvae and the other two contained eggs; in another case all contained eggs but the egg from the deepest cell hatched first. From this we concluded that the deepest cell is the first prepared and provisioned, and the others prepared a short distance off from the main tunnel progressively back toward the entrance. However, the cells were invariably very close together

and sometimes separated by only a very few millimeters of sand. We consider it probable that the wasp provisions a single nest over a period of more than one day (at least in some cases) since larvae and eggs were sometimes found in different cells of the same nest.

The number of leafhoppers in the twelve completed cells examined averaged 11 per cell (7–19); all were one species and nearly all adult females, as previously noted. All had the ventral side up; all seemed thoroughly paralyzed. A small percentage of the leafhoppers were parasitized by Dryinidae, as evidenced by dark sacs protruding from between the abdominal segments. The egg of the wasp was invariably found upon the uppermost leafhopper. The egg is whitish, about 2 mm. long, and is laid longitudinally along the ventral side of the thorax laterad of the leg-bases, extending back about as far as the second abdominal segment. Several eggs and two small larvae were kept for rearing. One of the eggs hatched the following day, but the others failed to hatch, and the two larvae failed to develop. Since we were on a prolonged field trip, it was not possible to care for these delicate insects properly. None of the leafhoppers showed any signs of recovery.

Filling and digging. As noted above, burrows were closed temporarily by a small amount of sand while the wasp was away hunting. The final closure of the burrow, after all the cells had been completed, was very different from this, taking upwards of 30 minutes. In the beginning stages, sand is probably scraped from the sides of the burrow, since by the time the wasp is seen outside, the burrow is almost filled. In later stages the wasp rakes sand from around the entrance into the burrow, then backs in and pounds it down with the tip of the abdomen, which is moved up and down vigorously, the tip describing more or less of a circle. These actions are very reminiscent of *Poecilopompilus interruptus* (Say), a pompilid wasp somewhat similar in color and mannerisms to *Psammaecius tricolor*. When the burrow is full of carefully packed sand, the wasp kicks sand over the entrance from a distance of up to 7 cm., producing a small mound which is then flattened out by kicking in various directions.

Apparently these wasps usually complete their nests in late afternoon and then dig a new nest which they spend the night in and begin provisioning the next morning. All the final fillings and all the new diggings we observed were between 5 and 7 P.M. In digging, the wasp backs out of the burrow in a straight line as much as 10 cm. dragging sand with the front legs, then works forward toward the burrow scuffing sand with the front legs. The result is a small trough extending out a few centimeters from the entrance. About 45 minutes are required to complete the nest, and the sand at the entrance is then leveled off before the wasp enters, closing from the inside. One such nest dug out at 6:50 P.M. contained the adult wasp in the empty cell, where she presumably would have spent the night; there was an outer closure of about 15 mm. of sand, and an inner closure of about the same size just before the cell.

Habits of Nysson bellus. Several of these tiny, brightly colored wasps were observed in the nesting area of *Psammaecius tricolor*. Since wasps of this genus are known to be cleptoparasites of Gorytini, we suspected them to be parasitizing *tricolor*. On only one occasion, however, was a *Nysson* seen to enter a nest. This specimen has been digging here and there near a *Psammaecius* nest without success. When the *Psammaecius* landed nearby, the *Nysson* remained motionless. After a moment's pause, the *Psammaecius* entered the nest with a leafhopper; the *Nysson* followed her in but came out almost immediately. The *Psammaecius* remained in the nest about 15 minutes, which was unusual behavior since she was not building a new cell. During this interval the *Nysson* entered the nest three times and came out twice. Finally the *Psammaecius* emerged while the *Nysson* was still inside, closed from the outside, and flew away. The *Nysson* emerged a few minutes later and was captured. The nest was then dug out and found to contain two cells, the innermost apparently completed. However, no eggs of either wasp were located in either cell, probably having been dislodged during the digging.

One cell in another nest was found to contain two larvae, one slightly larger than the other. Since none of our rearings

were successful, we were unable to be certain that one of these represented the larva of *Nysson,* and the evidence against *Nysson bellus* remains purely circumstantial. Reinhard (1925b) found that *Nysson hoplisivora* Rohwer enters the cell of *Psammaecius costalis* (Cresson) before it is fully provisioned and lays its egg under the wings of a prey. The *Psammaecius* later lays her egg on the top prey, but the *Nysson* egg hatches first and the larva destroys the *Psammaecius* egg, then feeds upon the contents of the cell.

Discussion. The Gorytini are usually regarded as a somewhat generalized tribe of the Nyssoninae, perhaps close to the stock which gave rise to the Stizini and finally the Bembicini. In this light certain aspects of the behavior of *Psammaecius tricolor* may be worth reviewing: (1) the species appears to be distinctly gregarious in its nesting; (2) the prey is carried by the middle legs, venter-up, beneath the body (as in the Bembicini); (3) the manner of digging strongly suggests the Bembicini; (4) the tip of the abdomen is used for packing the soil in the burrow. The last named habit is well developed in the Bembicini (and in certain other Sphecidae as well) and it is of considerable interest to find it well developed in *Psammaecius.* It will be many years before the phylogeny of behavior in the Sphecidae is thoroughly understood, and in the meantime we can do little more than speculate on some of the possibilities and await the accumulation of data on many more species.

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Two New Species of Perdita from North Carolina (Hymenoptera: Apoidea) [1]

By P. H. Timberlake, University of California Citrus Experiment Station, Riverside, California

Both of the following species of *Perdita* were discovered at Holly Shelter, North Carolina, by Professor T. B. Mitchell on October 5, 1951. Attempts to obtain additional specimens of *P. discreta* in 1952 failed, but *P. polygonellae* was collected again at the middle of September.

Perdita polygonellae n. sp.

A member of the *octomaculata* group, with a ferruginous abdomen. This is the only species of the group so far described that has this character, and it is also the only known eastern species of *Perdita* with an entirely red abdomen.

Female: Head and thorax dark olive green. Basal half of mandibles, sides of labrum, clypeus, lateral and supraclypeal marks, pale yellow. Mandibles shading into testaceous at middle and into rufous at apex. Middle of labrum more or less piceous. The usual pair of clypeal dots minute. Lateral marks large, higher than wide, narrowed above and ending obtusely at level of antennae. Supraclypeal mark generally a little notched above, and sometimes divided into two spots (rarely absent). Anterior border and large cuneate marks on each side of hind margin of pronotum, and the tubercles, yellow. Abdomen uniformly ferruginous, with only the lateral foveae of tergite 2 black, but occasionally (paratypes) with a faint brownish subapical band on the first segment, mostly in the form of sublateral oval spots, and a more distinct blackish spot on disk of tergite 5. Legs black, the under margin of posterior side and the apex of front femora, apex of middle femora, anterior side of front and middle tibiae and basitarsi, apex of hind femora, and apex of middle and hind coxae and their trochanters, yellow. Antennae blackish, the under side of scape

[1] Paper No. 767, University of California Citrus Experiment Station, Riverside, California.

pale yellow, the under side of flagellum dull yellowish. Tegulae testaceous, with a yellow basal mark. Wings somewhat dusky, the nervures and margins of stigma brown.

Head somewhat broader than long, with face below antennae gently convex. Clypeus only slightly produced and with the lateral extensions broad and nearly fully visible in frontal aspect. Middle of labrum produced, forming a small obtusely pointed lobe that is medially ridged beneath. Facial foveae twice as wide as interval between them and eye margin, and three-fourths as long as space between sockets and anterior ocellus. Pygidial plate with arcuate sides and a rather narrow, rounded apex. Tarsal claws with a minute inner tooth. Head and thorax nearly uniformly tessellate and dullish, with minute setigerous punctures more apparent on mesonotum than on frons. Pubescence of head and thorax pale ochreous, fairly long, erect, and moderately abundant. Length, 4.5–6 mm.; anterior wing, 3–3.5 mm.

Male: Similar to female, but mandibles, except rufous tips, labrum, and face almost or quite entirely below level of antennae, white. Subantennal plates sometimes green at lower end, varying from more than half green to entirely white. Posterior orbits yellowish white, sometimes nearly to middle of eyes, or the white reduced to a small spot near base of mandibles. Thorax and abdomen as in female, except that the abdomen is marked with fuscous on basal half of tergite 1 and usually with an apical dusky band on tergites 1 to 4 (or 5), this band frequently reduced to a transverse oval spot on each side, where the duskiness is accentuated, and rarely with an extension basad in median line as a spot or short stripe. Legs with the dark area on femora more reduced than in female. Scape of antennae yellow, except at apex above, the pedicel and flagellum blackish above and brownish yellow beneath. Tegulae as in female. Wings a little more dusky than in female, the nervures and margins of stigma blackish.

Head slightly broader than long, the cheeks no wider than the eyes. Lateral extension of clypeus broad and gradually reflexed. Facial foveae about twice as long as broad. Mandibles rather short, curved, and simple. Tarsal claws strongly

bifid, the teeth nearly equal. Labrum nearly normal. Apical tergite with a rather narrow, apically rounded pygidial process. Sculpture and pubescence very nearly as in the female. Length, 4.5 mm.; anterior wing, 3.2 mm.

Holotype female and *allotype,* Holly Shelter, NORTH CAROLINA, on *Polygonella polygama,* Oct. 5, 1951 (T. B. Mitchell). *Paratypes* from the same locality and flower: 33 females, 3 males, Oct. 5, 1951; 21 females, 17 males, Sept. 16, 1952.

Types to be deposited in the U. S. National Museum; paratypes in the collection of the author and of T. B. Mitchell.

Perdita discreta n. sp.

Similar to *P. octomaculata* (Say), but smaller with the markings white, those of abdomen reduced to small, transverse spots.

Female: Head and thorax dark green, the labrum and clypeus black. A narrow median stripe on clypeus, and small lateral marks, yellowish white. The latter slender and acute above at level of antennae and globosely widened opposite the clypeus (in paratype reduced to a narrow curved mark, not quite reaching level of antennae). Mandibles testaceous, becoming reddish at apex and with a white spot at base. Thorax entirely dark, the propodeum a little more bluish green than the mesonotum. Adbomen black, the customary bands represented by transversely linear white marks, one on each side of tergites 1 to 4; those on tergite 1 at base of disk and narrowly separated; those on following segments basal and widely separated, becoming a little oblique on tergites 2 and 3; and those on 4 sometimes evanescent (paratypes). Pygidial plate ferruginous. Antennae black, the flagellum slightly brownish beneath toward apex. Legs black, the tip of front and middle femora, extreme apex of hind femora above, anterior side of front tibiae and basitarsi, and a line on middle tibiae, pale yellow. Tegulae pale testaceous. Wings dusky (grayish), the margins of stigma and nervures fuscous.

Head about as wide as long, the facial foveae narrow and elongate. Stigma of anterior wings rather narrow; marginal cell with the parts beneath and beyond stigma equal. Pygidial

plate broad, slightly ridged medially and rounded or obscurely emarginato-truncate at apex. Tarsal claws with a small inner tooth near apex. Head and thorax dullish, densely tessellately shagreened, and impunctate except on anterior part of face. Abdomen microscopically lineolate. Pubescence moderately developed, erect, whitish, becoming pale ochreous on mesonotum. Length about 5 mm.; anterior wing, 3.1 mm.

Two females (*holotype* and *paratype*), Holly Shelter, NORTH CAROLINA, Oct. 5, 1951 (T. B. Mitchell). There is no flower record for these specimens but they carry a fine-grained yellow pollen, presumably from some Composite.

Holotype returned to T. B. Mitchell for ultimate deposit in the U. S. National Museum.

P. discreta and the four similar eastern forms of the *octomaculata* group may be distinguished as follows:

1. Markings yellow, including marks on pronotum and tubercles.....2
   Face with three small yellowish-white marks, the thorax entirely dark and the abdomen with transversely linear white marks on each side of tergites 1 to 3 or 4; length, 5 mm.....*discreta* n. sp.
2. Lateral face marks much higher than wide, generally terminated bluntly at anterior end of facial foveae; superclypeal mark sometimes developed.....3
   Lateral face marks triangular, usually hardly higher than wide and acute above; supraclypeal mark absent; abdominal marks usually widely separated, those on tergites 2 to 4 oblique; length, 7 mm.....*octomaculata* (Say)
3. Supraclypeal mark large.....4
   Supraclypeal mark absent or represented by two dots or a line; yellow band on tergites 1 and 4 (usually also on 5 and rarely on 3) narrowly interrupted, that on tergite 2, and usually on 3, widely interrupted, with the remnants oblique; length, about 8 mm...*consobrina consobrina* Timb.
4. Scape narrowly yellowish beneath; abdominal bands broad, those on tergites 2 and 3 moderately well, and the others narrowly interrupted; wings a little dusky.....*consobrina lepida* Timb.
   Scape yellow except above on apical half; abdomen with bands on first five segments moderately wide and narrowly interrupted medially; wings clear, the nervures yellowish; length, about 6–7 mm.....*swenki* Cwfd.

Aphids on Rudbeckia

Aphids have been observed to be very numerous upon *Rudbeckia occidentalis* in various shaded canyon areas of Utah and southern Idaho. Most of the aphid material, recently examined by Professor M. A. Palmer, proved to be *Macrosiphum cockerelli* Hottes. On September 6, 1945, this species was abundant on leaves and stems of these plants near the summit of Ephraim Canyon, Utah. Here a careful examination showed some syrphid larvae, adult and larval ladybird beetles, including adult *Hippodamia quinquesignata* Kirby and *H. lecontei* Muls., damsel bugs which were largely *Nabis alternatus* Parshley, and *Anthocoris* sp. preying on this aphid. This was the greatest concentration of predators the writer has observed associated with this species. Other collections of *M. cockerelli* in Utah include: American Fork Canyon and Mt. Timpanogos, July 26, 1942, Mt. Nebo, July 25, 1942, Santaquin Canyon, Settlement Canyon, Monte Cristo and Indian Canyon. Also very abundant on the same host at Mink Creek Canyon and Emigration Canyon, in southern Idaho, August 14, 1942, when C. F. Smith and I examined this host at several stops.

Macrosiphum rudbeckiarum (Cockerell) was collected at Mt. Nebo, Utah, August 14, 1943. It is less numerous than *M. cockerelli* on *Rudbeckia*. *M. rudbeckiarum* also was collected in Mink Creek Canyon, Idaho, August 14, 1942, by C. F. Smith and the writer.—G. F. KNOWLTON, Logan, Utah.

Current Entomological Literature

Compiled by VENIA T. PHILLIPS, Librarian

Academy of Natural Sciences of Philadelphia

Under the above head it is intended to note papers received at the Academy of Natural Sciences of Philadelphia and the University of Pennsylvania pertaining to entomology, including all arthropods except Crustacea. Coverage will be world-wide as regards major contributions to systematics as well as for all papers on morphology, physiology, embryology, etc. In addition, for species from the Americas and the Pacific (Nearctic, Neotropical and Polynesian regions) all minor contributions to taxonomy, distribution, etc., will also be recorded.

This list gives references of the year 1953 unless otherwise noted. Continued papers, with few exceptions, are recorded only at their first installment.

For other records of general literature and for economic literature, see the Bibliography of Agriculture, Washington, and the Review of Applied Entomology, Series A, London. For records of papers on medical entomology see Review of Applied Entomology, Series B.

NOTE: The figures within brackets [ ] refer to the journal in which the paper appeared, as numbered in the List of periodicals and serials published in our January and June issues. The number of the volume, and in some cases, the part, heft, &c. is followed by a colon (:). References to papers containing new forms or names not so stated in titles are followed by (*); if containing keys are followed by (k); papers pertaining exclusively to Neotropical species, and not so indicated in the title, have the symbol (S).

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GENERAL—d'Assis-Fonseca, E. C. M.—The pinning and setting of flies. [Ent. Record] 65: 264–66. **Cheesman, E.**—Insects: their secret world. Wm. Sloane Associates, N. Y., 246 p., ill. $3.50. (Reviewed by L. B. [64] 36: 124.) **Davis, J. J.**—Insects of Indiana for 1952. [Proc. Ind. Ac. Sci.] 62: 176–80. **Hall, R. R., A. E. R. Downe, C. R. MacLellan & A. S. West.**—Evaluation of insect predator-prey relationships by precipitin test studies. [92] 13: 199–204. **Hayward, K. J.**—An entomologist in Argentina. I. Early days. The Chaco Santafecino. [Ent. Record] 65: 249–55. **Hocking, B.**—The intrinsic range and speed of flight of insects. [126] 104: 223–345, ill. **Kato, M. & M. Toriumi.**—Studies on the associative ecology of insects. IV. Synecological analysis of the larval association of mosquitoes in the bambo thicket. [150] 19: 152–60, ill., 1951. **Leppik, E. E.**—The ability of insects to distinguish number. [15] 87: 229–36, ill. **Worth, C. B.**—Construction and use of a simplified window trap for insects. [92] 13: 204–06, ill. **Young, F. N.**—The approach to taxonomic problems. (Illus. by the Col. genus Matus.) [Proc. Indiana Ac. Sci.] 62: 172–75.

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190–98. **Vaillant, F.**—Un empidide destructeur de simulies. [Bull. Soc. Zool. France] 76: 371–79, ill., 1951. —Notes biologiques sur quelques Tachytrechus d'Afrique (Dolichopodidae). [Bull. Soc. Zool. France] 76: 379–83, ill., 1951. —Les premiers stades de Dolichopus griseipennis Stann. [Bull. Soc. Zool. France] 75: 80–4, ill., 1950. **Weems, H. V. Jr.**—Notes on collecting syrphid flies. [64] 36: 91–8

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2. Académie des Sciences, Comptes Rendus. Paris.
3. Academy of Natural Sciences of Philadelphia. Notulae Naturae.
4. Academy of Natural Sciences of Philadelphia. Proceedings.
5. Acta Biologica Venezuelica. Caracas.
6. Acta Biotheoretica. Leiden, Netherlands.
7. Acta Zoologica (Int. tidskrift för Zoologi). Stockholm.
8. Acta Zoologica Lilloana. Tucuman, Argentina.
9. American Entomological Society, Transactions. Philadelphia.
10. American Journal of Tropical Medicine & Hygiene. Baltimore, Md.
11. American Microscopical Society, Transactions. Menasha, Wisc.
12. American Midland Naturalist. Notre Dame, Ind.
13. American Museum Novitates. New York.
14. American Museum of Natural History, Bulletin. New York.
15. American Naturalist. Lancaster, Pa.
16. Anatomical Record. Philadelphia.
17. Annales de Parasitologie humaine et comparée. Paris.
18. Annales des Sciences Naturelles, Zoologie. Paris.
19. Annals and Magazine of Natural History. London.
20. Annals of Applied Biology. London.
21. Annals of Tropical Medicine and Parasitology. Liverpool.
22. Anti-locust Bulletin. London.
23. Archives de Zoologie Expérimentale et Générale. Paris.
24. Archives de Zoologie Expérimentale et Générale. Notes et Revue.
25. Arkiv för Zoologi. K. Svenska Vetenskapsakademien, Stockholm.
26. Arthropoda. Asoc. Argent. Artropodologia. Buenos Aires.
27. Australian Journal of Zoology. Canberra.
28. Beiträge zur Entomologie (Deutsch. Ent. Inst.) Berlin.
29. Beiträge zur Fauna Perus. Jena.
30. Biological Bulletin. Woods Hole, Mass.
31. Biological Society of Washington, Proceedings. Washington, D. C.
32. Boletin de Entomologia Venezolana. Caracas.
33. Bombay Natural History Society, Journal.
34. Bonner Zoologische Beiträge. Bonn, Germany.
35. British Museum (Nat. Hist.), Bulletin. Entomology.
36. Brooklyn Entomological Society, Bulletin.
37. Broteria, Ser. trimestral. Lisbon, Portugal.
38. Buenos Aires. Instituto Nac. Investig. Ciencias Nat. Zoologica.
39. Bulletin Biologique de la France et de la Belgique. Paris.
40. Bulletin of Entomological Research. London.
41. California Insect Survey, Bulletin. Berkeley, Cal.
42. California Univ. Publications in Entomology. Berkeley.
43. Canadian Entomologist. Ottawa, Ont.
44. Canadian Journal of Zoology. Ottawa, Canada.
45. Ceskoslovenska Spolecnost Ent., Casopis. (Acta Soc. Ent.) Prague.
46. Ceylon Journal of Science, Sect. B. Colombo.
47. Coleopterists' Bulletin. Arlington, Va.
48. Dusenia. Curitiba, Parana, Brazil.
49. Ecological Monographs. Durham, N. C.
50. Ecology. Durham, N. C.
51. Entomologica Americana. Brooklyn Ent. Soc.
52. Entomological Society of America, Annals. Columbus, Ohio.

53. Entomological Society of British Columbia, Proceedings. Vernon.
54. Entomological Society of Ontario, Annual Report. Guelph.
55. Entomological Society of Southern Africa, Journal. Pretoria.
56. Entomological Society of Washington, Proceedings. Washington, D. C.
57. Entomologische Berichten. (Ned. Ent. Ver.) Amsterdam.
58. The Entomologist. London.
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60. Entomologist's Monthly Magazine. London.
61. Eos; Revista Española de Entomologia. Madrid.
62. Evolution. New York.
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66. Great Basin Naturalist. Provo, Utah.
67. Harvard Museum of Comparative Zool. Breviora. Cambridge, Mass.
68. Harvard Museum of Comparative Zoology, Bulletin. Cambridge, Mass.
69. Hawaiian Entomological Society, Proceedings. Honolulu.
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90. Microentomology. Stanford University, California.
91. Mocambique; Documentario Trimestral. Lourenço Marques.
92. Mosquito News. New Brunswick, N. J.
93. Musei Zoologici Polonici, Annales. Warsaw, Poland.
94. Musei Zoologici Polonici. Fragmenta Faunistica. Warsaw, Poland.
95. Naples Univ. Instituto e Museo Zoologico, Annuario.
96. National Academy of Sciences, Proceedings. Washington, D. C.
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111. Pan-Pacific Entomologist. San Francisco, Cal.
112. Parasitology. London.
113. Physiological Zoology. Chicago.
114. Polskie Pismo Entomologiczne. Wroclaw, Poland.
115. Psyche; A Journal of Entomology. Cambridge, Mass.
116. Quarterly Journal of Microscopical Science. London.
117. Revista Brasileira de Biologia. Rio de Janeiro.
118. Revista de Investigaciones Agricultura. (Argent. Min. Agr.) B. A.
119. Revue Française de Lepidopterologie. Douelle, France.
120. Revue Suisse de Zoologie. Geneva, Switzerland.
121. Rio de Janeiro. Instituto Oswaldo Cruz, Memorias.
122. Rio de Janeiro. Museu Nacional do Brasil, Boletim, Zool.
123. Rivisti di Parassitologia. Rome, Italy.
124. Royal Entomological Society of London, Proceedings, Ser. A.
125. Royal Entomological Society of London, Proceedings, Ser. B.
126. Royal Entomological Society of London, Transactions.
127. Royal Society of London, Proceedings, Ser. B.
128. São Paulo, Brazil. Depart. Zool., Secr. Agr., Papéis Avulsos.
129. São Paulo, Brazil. Instituto Biologico, Arquivos.
130. Schweizerische Entomologische Gesellschaft, Mitteilungen. Bern.
131. Smithsonian Miscellaneous Collections. Washington, D. C.
132. Sociedad Cientifica Argentina, Anales. Buenos Aires.
133. Sociedad Entomológica Argentina, Revista. Buenos Aires.
134. Sociedad Mexicana de Historia Natural, Revista. Mexico City.
135. Société d'Histoire Naturelle de Toulouse, Bulletin.
136. Société Entomologique de Belgique, Bulletin et Annales. Brussels.
137. Société Entomologique de France, Annales. Paris.
138. Société Entomologique de France, Bulletin. Paris.
139. Société Fouad I d'Entomologie, Bulletin. Cairo, Egypt.
140. Société Linneenne Lyon, Bulletin Mensuel.
141. Société Zoologique de France, Bulletin. Paris.
142. Society for British Entomology, Journal. Bournemouth, England.
143. Society for British Entomology, Transactions. Bournemouth, Eng.
144. South London Entomological & Nat. Hist. Society, Proc. & Trans.
145. Southern California Academy of Sciences, Bulletin. Los Angeles.
146. Systematic Zoology. Washington, D. C.
147. Tennessee Academy of Sciences, Journal. Nashville.
148. Texas Journal of Science. College Station, Texas.
149. Tijdschrift voor Entomologie. Amsterdam.
150. Tohoku University. Science Reports, Ser. 4. Tohoku, Japan.
151. U. S. National Museum, Proceedings. Washington, D. C.
152. Washington Academy of Sciences, Journal. Washington, D. C.
153. Wasmann Journal of Biology. San Francisco, Cal.
154. Zoologica. New York.
155. Zoological Society of Bengal, Proceedings. Calcutta, India.
156. Zoological Society of London, Proceedings.
157. Zoologische Jahrbücher. Abt. Anatomie u. Ontogenie. Jena.
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This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

American Sarcophagidae—wanted for identification. H. R. Dodge, P.O. Box 185, Chamblee, Georgia.

German lepidopterist wishes to correspond and receive live material (eggs and pupae) in exchange for dried imagoes. Johannes Reichel, Koenigsberg, Krs. Wetzlar 16, Germany.

For exchange—The periodic Cicada, T. septendecim. Desire Lepid., espec. Papil., Sphing. & Speyeria. Also Col., espec. Ceramb. & Lucan. John W. Morris, 2704 Genesee St., Syracuse 9, N. Y.

Cynipid and Itonidid galls—American species wanted; purchase or exchange for British species. Fresh or dried. D. Leatherdale, F.R.E.S., Old Woodstock, Oxford, England.

Wanted—Reprints or papers concerning insects taken in Alaska for inclusion in list of Alaskan insects. R. H. Washburn, Alaska Experiment Station, Palmer, Alaska.

Conopidae of the World wanted. Will pay 10¢ to $1.00 for pinned and labelled specimens. S. Camras, 4407 N. Milwaukee Ave., Chicago 30, Illinois.

Anisoptera—Nearctic sp. wanted for exchange, espec. Ophiog., Arigom., Aeschna, Neurocor., Somatoc., Cordulia, Dorocor., Leucor. R. D. Cuyler, N. C. State College, Raleigh, N. C.

Bembicini and Stizini (Hym., Sphec.) of New World wanted for revis. study. Will return upon request or at end of project. James E. Gillaspy, Dept. of Zoology, Univ. Texas, Austin 12, Texas.

Agapema galbina. Will exchange cocoons of this moth for nature books. E. Frizzell, Route 4, Box 96, San Benito, Texas.

Wanted—Data on exact location of colonies of *Epibembex* (olim *Bembix*) (Hymenoptera), any species, any part of country, for biological studies. Howard E. Evans, Dept. Entomology, Cornell Univ., Ithaca, N. Y.

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